

What is claimed is:

1. A digital watermarking apparatus comprising:  
area specifying means for specifying a predetermined  
5 area in which a digital watermark is to be embedded, said  
predetermined area being included in received image signals;  
encryption data generating means for encrypting the  
digital watermark and for outputting encryption data; and  
mixing means for comparing an average of intensity values  
10 or color difference values of all pixels in a first area in  
the predetermined area in the received image signals with an  
intensity value or a color difference value of each pixel in  
a second area that is an area other than the first area in  
the predetermined area to find, for all pixels in the second  
15 area, a first counter value and a second counter value, said  
first counter value indicating a number of pixels each of which  
has an intensity value or a color difference value larger than  
the average, said second counter value indicating a number  
of pixels each of which has an intensity value or a color  
20 difference value smaller than the average, for transforming  
the intensity value or the color difference value of each pixel  
in the second area such that a relation between the first counter  
value and the second counter value becomes a preset relation  
according to a first value or a second value of the encryption  
25 data from said encryption data generating means, and for  
outputting the received image signals as watermarked image  
signals.

2. The digital watermarking apparatus according to claim  
30 1, wherein said mixing means comprises:

average calculating means for calculating the average  
of the intensity values or the color difference values of the  
pixels in the first area in the predetermined area of the  
received image signals;

35 counter value calculating means for comparing the  
average with the intensity value or the color difference value

of each pixel in the second area that is an area other than the first area in the predetermined area to calculate, for all pixels in the second area, the first counter value and the second counter value, said first counter value indicating the number of pixels each of which has an intensity value or a color difference value larger than the average, said second counter value indicating the number of pixels each of which has an intensity value or a color difference value smaller than the average;

counter value comparing means for comparing the first counter value and the second counter value; and

transforming means for transforming the intensity values or the color difference values of all pixels in the second area such that, when the value of the encryption data from said encryption generating means is the first value, said counter value comparing means gives a comparison result indicating that the first counter value is larger than the second counter value and such that, when the value of the encryption data from said encryption generating means is the second value, said counter value comparing means gives a comparison result indicating that the first counter value is smaller than the second counter value,

wherein the transformed signals are output as the watermarked image signals, the intensity value or the color difference value or each pixel in the second area of the transformed signals being transformed by said transforming means according to the value of the encryption data.

3. A digital watermarking method comprising:

a first step for specifying a predetermined area in which a digital watermark is to be embedded, said predetermined area being included in received image signals;

a second step for encrypting the digital watermark and for outputting encryption data; and

a third step for comparing an average of intensity values or color difference values of all pixels in a first area in

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the predetermined area in the received image signals with an intensity value or a color difference value of each pixel in a second area that is an area other than the first area in the predetermined area to find, for all pixels in the second area, a first counter value and a second counter value, said first counter value indicating a number of pixels each of which has an intensity value or a color difference value larger than the average, said second counter value indicating a number of pixels each of which has an intensity value or a color difference value smaller than the average, and

a fourth step for transforming the intensity value or the color difference value of each pixel in the second area such that a relation between the first counter value and the second counter value becomes a preset relation according to a first value or a second value of the encryption data and for outputting the received image signals as watermarked image signals.

4. The digital watermarking method according to claim 3, wherein said third step comprises:

a fifth step for calculating the average of the intensity values or the color difference values of the pixels in the first area in the predetermined area of the received image signals; and

a sixth step for comparing the average with the intensity value or the color difference value of each pixel in the second area that is an area other than the first area in the predetermined area to calculate, for all pixels in the second area, the first counter value and the second counter value, said first counter value indicating the number of pixels each of which has an intensity value or a color difference value larger than the average, said second counter value indicating the number of pixels each of which has an intensity value or a color difference value smaller than the average,

and wherein said fourth step comprises:

a seventh step for comparing the first counter value

and the second counter value; and

an eighth step for transforming the intensity values or the color difference values of all pixels in the second area such that, when the value of the encryption data is the first value, a comparison result indicating that the first counter value is larger than the second counter value is obtained and such that, when the value of the encryption data is the second value, a comparison result indicating that the first counter value is smaller than the second counter value is obtained.

5. A digital watermark reproducing apparatus comprising:

area specifying means for receiving digitally watermarked image signals as input signals and for specifying a predetermined area, said digitally watermarked image signals being generated by transforming signals in the predetermined area of the image signals according to a value of encryption data generated by encrypting a digital watermark;

extracting means for comparing an average of intensity values or color difference values of all pixels in a first area in the predetermined area in the digitally watermarked image signals with an intensity value or a color difference value of each pixel in a second area that is an area other than the first area in the predetermined area to find, for all pixels in the second area, a first counter value and a second counter value, said first counter value indicating a number of pixels each of which has an intensity value or a color difference value larger than the average, said second counter value indicating a number of pixels each of which has an intensity value or a color difference value smaller than the average, and for extracting from the predetermined area the encryption data which is determined to be a first value or a second value according to a relation between the first counter value and the second counter value; and

a decrypting means for decrypting the extracted the

encryption data to an original watermark for output.

6. A digital watermark reproducing apparatus according to claim 5, wherein

5       said extracting means comprises:

          average calculating means for calculating the average of the intensity values or the color difference values of the pixels in the first area in the predetermined area of the digitally watermarked image signals;

10       counter value calculating means for comparing the average with the intensity value or the color difference value of each pixel in the second area that is an area other than the first area in the predetermined area to calculate, for all pixels in the second area, the first counter value and  
15       the second counter value, said first counter value indicating the number of pixels each of which has an intensity value or a color difference value larger than the average, said second counter value indicating the number of pixels each of which has an intensity value or a color difference value smaller  
20       than the average;

          counter value comparing means for comparing the first counter value and the second counter value; and

          encryption data extracting means for extracting the encryption data determined to be the first value when said  
25       counter value comparing means gives a comparison result indicating that the first counter value is larger than the second counter value or for extracting the encryption data determined to be the second value when said counter value comparing means gives a comparison result indicating that the  
30       first counter value is smaller than the second counter value.

7. A digital watermark reproducing method comprising:

          a first step for receiving digitally watermarked image signals as input signals and for specifying a predetermined  
35       area, said digitally watermarked image signals being generated by transforming signals in the predetermined area of the image

signals according to a value of encryption data generated by encrypting a digital watermark;

5 a second step for comparing an average of intensity values or color difference values of all pixels in a first area in the predetermined area in the digitally watermarked image signals with an intensity value or a color difference value of each pixel in a second area that is an area other than the first area in the predetermined area to find, for all pixels in the second area, a first counter value and a  
10 second counter value, said first counter value indicating a number of pixels each of which has an intensity value or a color difference value larger than the average, said second counter value indicating a number of pixels each of which has an intensity value or a color difference value smaller than  
15 the average;

a third step for extracting from the predetermined area the encryption data which is determined to be a first value or a second value according to a relation between the first counter value and the second counter value; and

20 a fourth step for decrypting the extracted encryption data to an original watermark for output.

8. A digital watermark reproducing method according to claim 7,

25 wherein said second step comprises:

a fifth step for calculating the average of the intensity values or the color difference values of the pixels in the first area in the predetermined area of the digitally watermarked image signals; and

30 a sixth step for comparing the average with the intensity value or the color difference value of each pixel in the second area that is an area other than the first area in the predetermined area to calculate, for all pixels in the second area, the first counter value and the second counter value,  
35 said first counter value indicating the number of pixels each of which has an intensity value or a color difference value

larger than the average, said second counter value indicating the number of pixels each of which has an intensity value or a color difference value smaller than the average, and wherein said third step comprise:

5        a seventh step for comparing the first counter value and the second counter value; and

10        an eighth step for extracting the encryption data determined to be the first value when said seventh step gives a comparison result indicating that the first counter value is larger than the second counter value or for extracting the encryption data determined to be the second value when said seventh step gives a comparison result indicating that the first counter value is smaller than the second counter value.